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10/772,805	02/04/2004	Michael R. Keenan	7213/99838	5230

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EXAMINER	
ABDELNOUR, AHMED F	

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2624	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/772,805	KEENAN, MICHAEL R.	
	Examiner	Art Unit	
	Farras Abdelnour	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 August 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,5-12 and 14-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *10-12,14-20 and 22* is/are allowed.

6)☒ Claim(s) *1-3 and 5-9* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Specification

1. The examiner acknowledges specification amendment reflected in the definition of the weighted concentration matrix.

Claims

2. Amendment of claims 1, 2, 5, 6, 8-11, 14, 15, 17, and 18 acknowledged. Cancelled claims 4 and 13 acknowledged. New claims 21 and 22 acknowledged.

Response to Arguments

3. Applicant's arguments filed August 30, 2007 have been fully considered. Claims 1-3 and 5-9 remain rejected. Regarding Claim 1, Vogt clearly teaches compressing a data matrix using wavelets, then factoring the compressed matrix into two matrices, then reconstructing one of the two product components.

4. Claims 10-12, 14-20, and 22 are allowed.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-3, 5 and 8 rejected under 35 U.S.C. 103(a) as being unpatentable over F. Vogt *et al.* (F. Vogt and M. Tacke, "Fast principal component analysis of large data sets," Chemometrics and Intelligent Laboratory Systems, Volume 59, Issues 1-2, 28 November 2001, Pages 1-18.).

Regarding Claim 1, Vogt *et al.* disclose a method for analyzing multivariate images, comprising:

a) providing a data matrix D containing measured spectral data (Equation 1, page 1),

b) transforming the data matrix D, using a wavelet transform, to obtain a transformed data matrix $\check{D}$ ("As a first step, all calibration spectra M are wavelet transformed," page 3, column 2),

c) thresholding the wavelet coefficients of the transformed data matrix ("These wavelet coefficients in M are analyzed for their relevance, i.e. whether they represent spectral features, or whether they are irrelevant. For this discrimination, a threshold is needed whose determination is discussed in Section 2.2," page 3, column 2),

d) performing an image analysis on the transformed data matrix $\check{D}$ to obtain a concentration matrix C and a spatially compressed spectral shapes matrix $\check{S}$ ("shrunken PCs are obtained in the wavelet domain, the rows of V^T," page 4, column 1; also consult Figure 1 depicting compressed, wavelet transformed matrix M), and

e) computing a spectral shapes matrix S from the spatially compressed concentration matrix Š ("Due to the orthogonality of the wavelet transformation and its inverse, scalar products are preserved, i.e. orthonormal PCs (rows of V^T) in the wavelength domain can be obtained by this inverse wavelet transformation from the orthonormal PCs in the wavelet domain," page 4, column 2).

While Vogt *et al.* discloses compressing loading matrix S for the benefit of faster computation and reduced data, it does not explicitly disclose compressing matrix C (matrix U·S in Vogt, equations 1 & 2) using wavelet transform followed by taking the inverse transform of the compressed matrix. It would have been obvious at the time the invention was made to one of ordinary skill in the art to apply Vogt's technique of factoring matrix M into matrix U·S (matrix C in application) and matrix V^T (matrix S in application), followed by wavelet compressing matrix M leading to one of the factors U·S and V^T to be compressed then followed by taking the inverse wavelet transform to the case where matrix U·S is now compressed followed by taking the inverse wavelet transform of the compressed Č matrix for the purpose of efficiently analyzing scores matrix by removing the redundant elements of the matrix.

The obviousness rationale advanced hereinabove is consistent with the criteria articulated in *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (U.S. 2007).

Regarding Claim 2, Vogt *et al.* disclose The method of Claim 1, wherein the data matrix D comprises a total of j blocks of data D_i, each data block D_i thereby providing a concentration block C_i in step e), and wherein steps a) through e) are repeated

sequentially until the concentration matrix C is accumulated blockwise, according to C = [C_1 C_2 ... C_{j-1} C_j] (From equation 1 in Vogt, taking the product of matrix M and the inverse of matrix V^T, we obtain matrix C blockwise by multiplying each row of M (a row block) by the corresponding column of the inverse of V^T (a column block), leading to matrix C).

Regarding Claim 3, Vogt *et al.* disclose the method of Claim 1, wherein the wavelet transform comprises a Haar transform ("Use of Haar- or Daubechies wavelets involving periodic boundary conditions make sure, that a perfect reconstruction of the original signals by the inverse transformation is possible," page 3, column 1).

Regarding Claim 5, Vogt *et al.* disclose the method of claim 1, wherein the thresholding comprises decimating the detail coefficients (Decimation is a standard operation in wavelets, including Haar wavelet).

Regarding Claim 8, Vogt *et al.* disclose The method of Claim 1, wherein the computing step e) comprises applying an inverse wavelet transform to the spatially compressed concentration matrix Č to provide the concentration matrix C ("Due to the orthogonality of the wavelet transformation and its inverse, scalar products are preserved, i.e. orthonormal PCs (rows of V^T) in the wavelength domain can be obtained by this inverse wavelet transformation from the orthonormal PCs in the wavelet domain," page 4, column 2).

7. Claims 6, 7, and 9 rejected under 35 U.S.C. 103(a) as being unpatentable over F. Vogt *et al.* as applied to claim 1, and Andrew *et al.* ("Rapid analysis of Raman image data using two-way multivariate curve resolution," J.J. Andrew and T.M. Hancewicz, Applied Spectroscoy, Vol. 52, Number 6, 1998).

Regarding Claim 6, Vogt discloses a method for analyzing multivariate images in claim 1. Vogt does not disclose obtaining concentration and spectral shape matrices via least square methods. Andrews teaches the method of Claim 1, wherein the image analysis of step d) comprises an alternating least squares analysis and the spatially compressed concentration matrix Č and the spectral shapes matrix S are obtained from a constrained least squares solution of rnin $||D- CS^T||_F$ ("The usual way this second step is achieved is by using an iterative constrained least-squares method referred to as alternating least-squares," page 798, column 2).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to apply Andrews' method of finding concentration and spectral shape matrices to Vogt's method of analyzing multivariate images for the purpose of obtaining an accurate estimates of matrices Č and S.

Regarding Claim 7, the Vogt-Andrews combination teaches the method of Claim 6, wherein the alternating least squares analysis comprises a transformed non-negativity constraint ("Raman intensity values, which are related to component

concentration, must also always be greater than or equal to zero. These non-negative constraints are imposed on the data structure during the least-squares optimization process," page 800, column 1).

Regarding Claim 9, the Vogt-Andrews combination teaches the method of Claim 1, wherein the computing step e) comprises projecting the data matrix D from step a) onto the spectral shapes matrix S from step d), according to rnin $||D- CS^T||_F$ ("The usual way this second step is achieved is by using an iterative constrained least-squares method referred to as alternating least-squares," page 798, column 2).

8. Claim 21 rejected under 35 U.S.C. 103(a) as being unpatentable over F. Vogt *et al.* as applied to claim 1, and Kotula *et al.* ("Automated analysis of SEM X-ray spectrum images: A powerful new microanalysis tool," P.G. Kotula, M.R. Keenan, and J.R. Michael; supplied by applicant).

Regarding Claim 21, Vogt discloses a method for analyzing multivariate images in Claim 1. Vogt does not disclose weighted data matrix. Kotula teaches weighted data matrix resulting from weighting each raw spectrum as described in the first equation in page 4. Performing weighting to all component spectra yields a weighted matrix.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to apply Kotula's matrix weighting technique to Vogt's multivariate image analysis for the purpose of simplifying necessary computations.

Allowable Subject Matter

9. The following is a statement of reasons for the indication of allowable subject matter: Claim 10 and its dependents (Claims 11, 12, 14-20, and 22) are allowed. While Vogt performs image analysis by compressing the image by means of wavelet transform, followed by factoring the resulting compressed image into two matrices, Vogt does not explicitly or implicitly disclose first factoring the data matrix into two matrices then taking the wavelet transform of one of the resulting factors for the purpose of compression. Moreover, no prior art teaches first factoring an image into two matrices followed by evaluating the wavelet transform of one of the resulting factors for the purpose of image compression.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Farras Abdelnour whose telephone number is 571-270-1806. The examiner can normally be reached on Mon. - Thurs. 7:30 - 17:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian P. Werner can be reached on 571-272-7401. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Farras Abdelnour
Examiner
Art Unit 2624

FA

WENPENG CHEN
PRIMARY EXAMINER

11/26/07